Articulation changes over time: An implication for vowel plots.

Vowel changes as part of language change in general, and as vowel shifts and mergers specifically, are often understood as discrete operations of a specific vowel quality over some vowel space, i.e., research is usually preoccupied with the relation between a vowel's first two formants (Docherty and Foulkes, 1999, Thomas, 2002). The vowel shift in Northern Cities English, e.g., involves a rising of [æ] through the vowel space, a falling and backing of [ɪ, ɛ], etc. (Labov, et al., 1972 et seq.). One persistent question is how can vowels occupy the same or proximate space at one time? If vowels are literally two spots in a two dimensional space, then mergers or perceptual confusion should frequently occur. Building on the assumption that vowels are dynamic polyphthongs instead of fairly stable points in time and that relatively slower gestures entail some perceptual benefit, this paper argues that dialect gestures are best understood using a vowel plot properly informed by articulatory timing. Specifically, vowel shifts are not due to Labov's (1994) peripherality as much as to the shape of the vowel discourse through the vowel space. This is seen clearest in the Northern Cities' [æ].

Measurement of articulatory timing is not easy without the use of instruments usually making reference to some amount of pellet tracking (e.g., MRI and ultrasound with pellets, x-ray microbeam, EMMA), nor are articulation studies generally without detractors. Nevertheless, articulation studies can provide insight into the time course of vowel gestures, and in such an analysis, inform our understanding of language change. An analysis is reported of ten female and male subjects from traditionally-defined dialect regions of Wisconsin (Inland North and Northern Cities). These subjects are part of the publicly available X-ray microbeam database from the University of Wisconsin-Madison. Pellets record movement of specific fleshpoints on the midsagittal plane, specifically four points on the tongue, points on the upper and lower lips, and two points on the mandible, As part of an extensive protocol, vowels were produced in one utterance where the canonical vowels of American English appeared in a [s __ d] frame: *said*, *sod*, etc. (Westbury, 1994). Vowel formants and gestures were measured. From pellet positions the velocity was calculated, and from the ensuing velocity trace, periods of slow pellet movement were identified.

Relating pellet speed with perceptual vowel space (F3-F2 v. F3-F1 in Bark) reveals aspects of dialect gestures which are not readily apparent from traditional vowel space plots. First, the period of the vowel in which certain parts of the tongue move the slowest often co-varies with greater vowel diffusion. Second, most speakers' [æ] are identified by pellet speed as diphthongal. Third, when combined with an analysis of the intensity contour, pellet speed identifies the primary vowel quality, especially with regard to /æ/ vowels as "increasing diphthongs" ([ɛæ], e.g.; Heffner, 1950). Discussed are implications of this finding for the practice of sociophonetics, the explanation of language change, the positioning of the westernmost dialect boundary in Wisconsin, and an understanding of technology using midsagittal pellets.

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